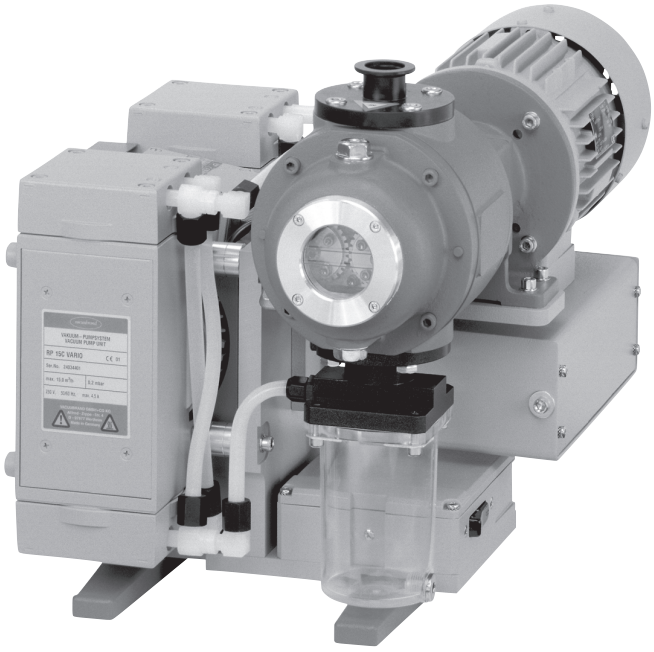
vacuubrand

Technology for Vacuum Systems

Instructions for use



RP 12C
RP 15C VARIO
RP 22C VARIO
RP 35C VARIO

Roots pumping units

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Dear customer,

Your VACUUBRAND diaphragm pumps should support you for a long time without trouble and with maximal power. Thanks to our long practical experience we have much information how you could ensure powerful application and personal safety. Please read these instructions for use before the initial operation of your pump.
VACUUBRAND diaphragm pumps are the result of many years of experience in construction and practical operation of these pumps combined with the latest developments in material and manufacturing technology.

Our quality maxim is the ”zero fault principle”:
Every diaphragm pump, leaving our company, is tested intensively including an endurance run of 18 hours. Therefore also faults, which occur rarely, are identified and can be eliminated immediately.
The achievement of the specifications after the endurance run is tested for every pump.
Every VACUUBRAND pump achieves the specifications. We feel obliged to this high quality standard.
We know that the vacuum pump can not take a part of your real work and hope that our products contribute to an effective and trouble-free realisation of your work.

Yours
VACUUBRAND GMBH + CO KG

After sales service: Contact your local dealer or call +49 9342 808-193.

Attention! Important notes!

Not permitted! Misuse may cause damage.

Caution! Hot surface!

Isolate equipment from mains.

Note.

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Contents

Safety information! 4

Technical data 9

Use and operation 12

Troubleshooting 14

Oil change 16

Replacing diaphragms and valves 17

Notes on return to the factory 26

Health and safety clearance form 27

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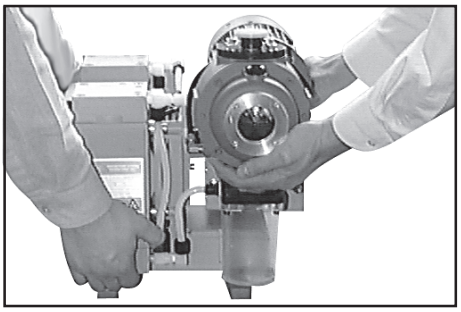
Safety information!

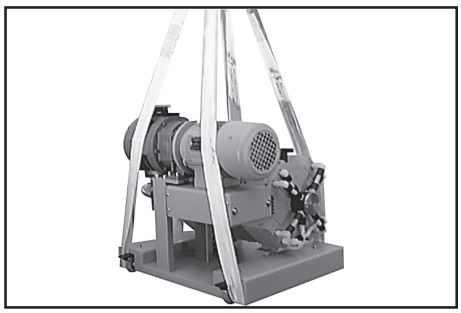
Remove all packing material, remove the product from its packing-box, remove protective covers from inlet and outlet ports and keep them. Inspect the equipment.
If the equipment is damaged, notify the supplier and the carrier in writing within three days; state the item number of the product together with the order number and the supplier's invoice number. Retain all packing material for inspection.
Do not use the equipment if it is damaged.
If the equipment is not used immediately, replace the protective covers. Store the equipment in suitable conditions.

☞ **Read and comply with this manual before installing or operating the equipment.**

Note: See figures on how to lift up and carry the pumping unit.
The handles at the diaphragm pump are not suitable to lift up and carry the complete pumping unit.



RP 12C and 15C VARIO



RP 22C/35C VARIO

Use the equipment **for the intended use only,** i. e. for generation of vacuum.

☞ **Prevent any part of the human body from coming in contact with the vacuum.**
☞ Comply with notes on correct vacuum and electrical connections.
☞ Adopt suitable measures to avoid that liquids flow on or into the pump motor when assembling or disassembling vacuum connections at the pump. **Risk of corrosion and/or short circuit!**
☞ Take care when connecting and deconnecting the vacuum tube.
☞ Make sure that the individual components are only connected, combined and operated according to their design and as indicated in the instructions for use.

☞ **Avoid continuous operation of the roots pumping unit RP 12C at inlet pressures > 50 mba**r in order to prevent overheating caused by the compression heat at high inlet pressure and to prevent blockade of the rotors or activation of the thermal cutout in the winding of the roots pump's motor.

Comply with **national safety regulations and safety requirements** concerning the use of vacuum and electrical equipment.

☞ Equipment must be connected to a **suitable fused and protected electrical supply** and a suitable earth point. Failure to connect the motor to ground may result in deadly electrical shock.
☞ The supply cable may be fitted with a moulded European IEC plug or a plug suitable for your local electrical supply. If the plug has been removed or has to be removed, the cable will contain wires colour coded as follows: green or green and yellow: earth; blue or white: neutral; brown or black: live.
☞ Check that mains voltage and current conform with the equipment (see rating plate).

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Comply with all **relevant safety requirements** (regulations and guidelines) and adopt suitable safety measures.
The mains on/off switch is located sidewise at the terminal box. The pumps cannot be hooked up separately.

- ☞ If the equipment is brought from cold environment into a room for operation, allow the equipment to warm up (pay attention to water condensation on cold surfaces).
- ☞ Ensure that installation is in compliance with limitations from the degree of protection, see section "Technical Data".

- ☞ **RP 15C/22/35/ VARIO only**: After switching off the pump, wait at least 3 minutes before next switching on.
- ☞ **RP 15C/22/35/ VARIO only**: Due to the high leakage current (up to 3.5 mA), a too low rated FI-safety switch may be activated.

Comply with all other relevant safety requirements (e.g. safety at work regulations for laboratories and explosion protection guidelines).

- ☞ Ensure that the equipment is suitable for the intended operation.
- ☞ Provide a firm level platform for the equipment and check that the system to be evacuated is mechanically stable and that all fittings are secure.
  Attention: Flexible elements tend to shrink when evacuated.

Due to the high compression ratio of the pumps, pressure at the outlet port might be generated being higher than the max. permitted pressure compatible with the mechanical stability of the system.

- ☞ Comply with **maximum permitted pressures** and pressure differences, see section "Technical data". Do not operate the pump with overpressure at the inlet.

Do not permit any **uncontrolled pressurizing** (e. g. make sure that the exhaust pipeline cannot get blocked). If you have an exhaust-isolation valve, make sure that you cannot operate the equipment with the valve closed. **Risk of bursting!**

- ☞ Ensure that the system design does not allow the exhaust pipeline to get blocked.
- ☞ Avoid overpressure of more than 0.2 bar in case inert gas is connected.
- ☞ The diameter of the inlet and outlet pipeline should be at the least as large as the diameter of the pump connection pipelines.

Pay attention to symbol "hot surfaces" on the equipment.

- ☞ Adopt suitable measures to prevent any danger arising from the formation of hot surfaces or electric sparks.
- ☞ Make sure ventilation is adequate if pump is installed in a housing or if ambient temperature is elevated.

To the best of our knowledge the equipment is in compliance with the requirements of the applicable EC-directives and harmonized standards (see "Declaration of conformity") with regard to design, type and model, especially directive IEC 1010. This directive gives in detail conditions, under which the equipment can be operated safely (see also IP degree of protection).

- ☞ Adopt suitable measures in case of differences, e. g. using the equipment outdoors, installation in altitudes of more than 1000 m above mean sea level, conductive pollution or moisture.

The pumps have no approval for operation in or for pumping of potentially explosive atmospheres.

If pumping **different substances**, purge the pump with inert gas prior to changing the pumped media in order to pump out residues and to avoid reactions of the pumped substances with each other with and the pump material.
Take into consideration interactions and chemical reactions of the pumped media.

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The pumps are **not suitable** for pumping substances which may form **deposits** inside the pump.

☞ If there is a danger of the formation of **deposits** in the pump chamber (check inlet and outlet of the pump) inspect the pump chamber regularly and clean if necessary.

The pumps are **not suitable** to pump **unstable substances** and substances which react explosively under **impact** (mechanical stress) and/or when being exposed to **elevated temperatures** without air.
The pumps are **not suitable** to pump **self inflammable** substances, substances which are inflammable without air and **explosive substances**.
The pumps are **not suitable** for pumping dust and have **no approval** for operation below ground.

Ensure that the **materials of the wetted parts are compatible with the pumped substances**, see section "Technical data".

☞ If residues can occur or if aggressive or condensable substances may enter the product, install suitable protection (e.g. gas washing bottle).
☞ Adopt suitable measures to prevent the release of dangerous, explosive, corrosive or polluting fluids.
☞ Use inert gas for gas ballast or venting if necessary.
☞ The user must take suitable precautions to prevent any formation of explosive mixtures in the expansion chamber. In case of a diaphragm crack, mechanically generated sparks, hot surfaces or static electricity may ignite these mixtures.
☞ Take adequate precautions to protect people from the effects of dangerous substances (chemicals, thermal decomposition products of fluoroelastomers), wear appropriate safety-clothing and safety glasses.
☞ Comply with applicable regulations when disposing of chemicals. Take into consideration that chemicals may be polluted.

Always allow the pump to continue to run for a few minutes with the inlet closed or with little gas ballast.

Adopt suitable measures to prevent any danger arising from potentially **explosive or flammable** mixtures.

☞ Use inert gas for venting the equipment.
☞ As regards root pumps, the rotors rotate with a minimum clearance and at high speed relatively to each other as well as along the housing. The clearance can become smaller because of the thermal expansion due to compression heat. Therefore, the pumping unit RP 12C must not be operated continuously at inlet pressures > 50 mbar.

Due to the residual **leak rate of the equipment**, there may be an exchange of gas, albeit very small, between the environment and the vacuum system.

☞ Adopt suitable measures to prevent contamination of the pumped substances or the environment.

Avoid overpressure at the gas ballast valve in case of high inlet pressure due to the high compression ratio.

☞ Pumped gases or collected condensate may leak in case the valve is open.
☞ Ensure that the inlet pipeline does not become contaminated when using inert gas.

☞ Avoid high heat supply (e. g. due to hot process gases).
☞ Pay attention to the max. permitted ambient temperature and make sure ventilation is adequate especially if the equipment is installed in a housing.

In case of excess temperature, the motor of the diaphragm pump respectively the motor of the Roots pump is shut down by a **self-hold thermal cutout** in the winding.

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☞ If the diaphragm pump is shut down, the Roots pump is not shut down automatically. However, the variable speed drive of the Roots pumps of the pumping units RP 15C/22C/35C VARIO reduces the speed of the Roots pump following a limiting current regulation, if necessary to standstill of the Roots pump. In case of excess temperature, the motor of the Roots pump is shut down by a separate **self-hold thermal cutout** in the winding.
☞ If the Roots pump is shut down or if the speed of the pumping units RP 15C/22C/35C VARIO is reduced, the diaphragm pump continues to run.

Attention: In each case manual reset is necessary. Switch off the pumping unit or isolate the equipment from mains. Identify and eliminate the cause of failure. Allow the pump to cool down sufficiently before restart.

Ensure that in case of failure the pump and the vacuum system always will turn into a safe status.
☞ In case of diaphragm cracks or leaks in the manifold pumped substances might be released into the environment or into the pump housing. To reduce the risk of leaks, ask for a diaphragm pump with additional safety diaphragm.
☞ Comply especially with notes on operation and use and maintenance.

☞ Failure of the pump (e. g. due to power failure) must not lead to a critical dangerous situation under any circumstances.

Electronic equipment is never 100% fail-safe. This may lead to an indefinite status of the equipment. Provide protective measures against misfunction and failure.
☞ Operating the pump, stand still of the pump or operating the air admittance valve must not lead to a critical dangerous situation under any circumstances.

Under normal conditions, pump oils and lubrications are not toxic and their use entails no danger. Certain hazards are, however, associated with some of these products. The following precautions must be adopted during use and operation in order to meet health and safety requirements.

Adopt precautionary measures (e. g. wear appropriate safety-clothing and protective goggles) to avoid excessive contact with the skin and possible skin irritations (including dermatitis).
Do not inhale or swallow. Maintain adequate levels of hygiene and cleanliness.
Ensure that the pump location is well ventilated and that possible toxic effects of certain vapours are avoided.
☞ Use suitable collecting and disposing systems if necessary.

Operate the roots pump only, if the oil filling is sufficient (see section ”Oil change”).
Use only **oil of the recommended type**.
Other oils or operating fluids may cause dangers or damage of the pump.

Use only **genuine spare parts and accessories.**
☞ Otherwise safety and performance of the equipment as well as the electromagnetic compatibility of the equipment might be reduced.
Possibly the CE mark becomes void if not using genuine spare parts.

Use special oils for the roots pump if:
☞ The pump operates in the vicinity of potential ignition sources.
☞ Oxygen or other flammable gases account for a large proportion of the evacuated gases.

Do not allow oils to be poured into or enter the drainage system or other bodies of water. Spillage can cause accidents. Use suitable means for removing spilt oil.
Observe all relevant statutory requirements and regulations concerning the use, storage and disposal of oil.

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The A-weighed emission sound pressure level of the pump does not exceed 70 dB(A). Measurement according to EN ISO 2151:2004 and EN ISO 3744:1995 with standard silencer or exhaust tube at outlet.

Ensure that maintenance is done only by suitable trained and supervised technicians. Ensure that the maintenance technician is familiar with the safety procedures which relate to the product processed by the vacuum system and that the equipment, if necessary, is appropriately decontaminated before starting maintenance.
Comply with local and national safety regulations.

Wear parts have to be replaced regularly. In case of normal wear the lifetime of the diaphragms and valves is > 10000 operating hours. Bearings have a typical durability of 40000 h. Motor capacitors have a typical durability in the range of 10000 to 40000 h depending strongly on the operation conditions like ambient temperature, humidity or load.

☞ Check every capacitor regularly by measuring its capacity and estimating its operation time. Exchange old capacitors early enough to prevent a failure. If an overaged motor capacitor fails it might get hot and even melt and may cause a flame to form which could be **dangerous for persons and equipment in the vicinity**. The capacitors have to be replaced by an electrician.

Ensure that **maintenance** is done only by suitably trained and supervised technicians. Ensure that the maintenance technician is familiar with the safety procedures which relate to the products processed by the pumping system.

Never disassemble the aggregatof the Roots pump but return it to the factory for repair or maintenance.

➨ **Isolate equipment from mains** before starting maintenance and **wait two minutes** to allow the capacitors to discharge.

☞ **Before starting maintenance** vent the system, isolate the pump and other components from the vacuum system and the electrical supply. Drain condensate if applicable, avoid the release of pollutants. Allow sufficient cooling of the pump.

Ensure that the pump cannot be operated accidentally. Never operate the pump if covers or other parts of the pump are disassembled. Never operate a defective or damaged pump.

☞ **Attention:** The pump might be contaminated with the process chemicals that have been pumped during operation. Ensure that the pump is decontaminated before maintenance and take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred.
☞ Wear appropriate safety-clothing when you come in contact with contaminated components.

In order to comply with law (occupational, health and safety regulations, safety at work law and regulations for environmental protection) vacuum pumps, components and measuring instruments returned to the manufacturer can be repaired only when certain procedures (see section **"Notes on return to the factory"**) are followed.

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Technical data

Type		RP 12C	RP 15C VARIO	RP 22C VARIO	RP 35C VARIO
Max. pumping speed* 50/60 Hz (ISO 21360)	m^3/h	12 / 14	15	22	40
Ultimate total pressure* (absolute)[a.)]	mbar	0,2	0,2	0,2	0,1
Ultimate total pressure with gas ballast*	mbar	0,4	0,4	0,9	0,9
Max. permitted outlet pressure (absolute)	mbar	1,1	1,1	1,1	1,1
Max. permitted pressure at inert gas connection (absolute)	bar	1,2	1,2	1,2	1,2
Ambient temperature range storage / operation	°C	+10 to + 40 / +10 to + 40			
Max. permitted relative atmospheric moisture (operation)	%	30 to 85			
Degree of protection IEC 529		IP 20			
Type of roots pump		MBS 030	MBS 030	MBS 030	MBS 050
Oil capacity (roots pump)	ml	210	210	210	335
Recommended oil		VACUUBRAND B-oil			
Rated motor power diaphragm pump roots pump	 W W	 200 300	 200 300	 390 300	 390 300
Motor protection					
Rated current draw at: 230 V ~ 50/60 Hz	A	3,9/4,5	max. 4,5	max. 5,0	max. 5,0
Max. permitted range of supply voltage		230 V +/-10% 50 Hz 230 V +5/-10% 60 Hz			
Rated speed at 50/60 Hz diaphragm pump	 min^{-1}	 1500 / 1800			
roots pump	min^{-1}	3000 / 3600	300 - 3600		
Inlet small flange	 NW	 25			 40
Outlet		hose nozzle NW 10			
Overall dimensions (approx.) L x W x H	mm	460x340x360	495x340x360	570x440x460	585x440x475
Mass	kg	34,4	36,8	53,0	55,6

* The pump achieves its ultimate pumping speed and ultimate total pressure only at operating termperature (after approx. 60 mins).

We reserve the right for modifications without prior notice!

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Components	Wetted parts
Diaphragm pump	
Housing cover insert	PTFE, carbon reinforced
Head cover	ETFE carbon fibre reinforced
Diaphragm clamping disc	ETFE carbon fibre reinforced
Valves	FFKM
Diaphragm	PTFE
Inlet	ETFE/ECTFE / stainless steel
Outlet	ETFE/ECTFE
Hoses	PTFE / stainless steel
Screw-in fittings	ETFE/ECTFE
Roots pump	
Inlet/outlet	Aluminium alloy, anodized, PFA coated
Rotors, pump chamber	PTFE coated
Seperator	PE / PMP
O-rings	NBR
Shaft seal, motor	PTFE
Shaft seals, gear	FPM

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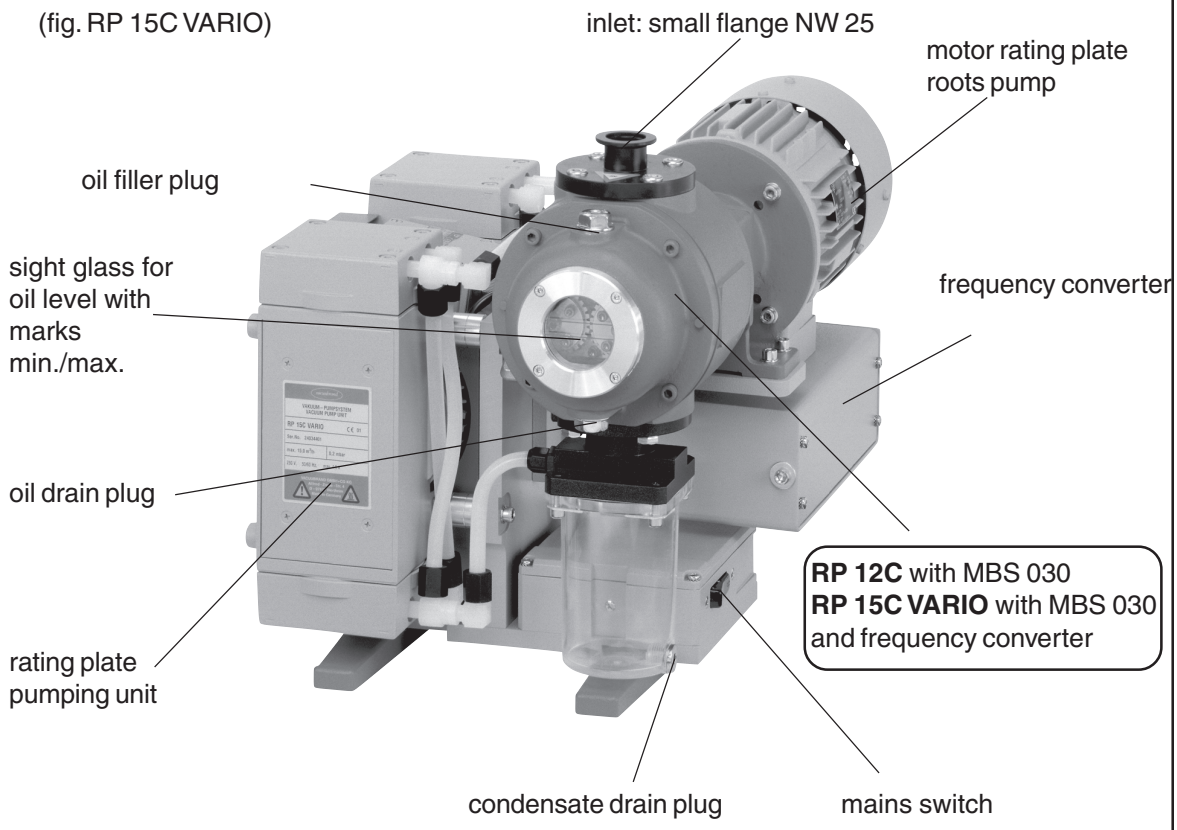
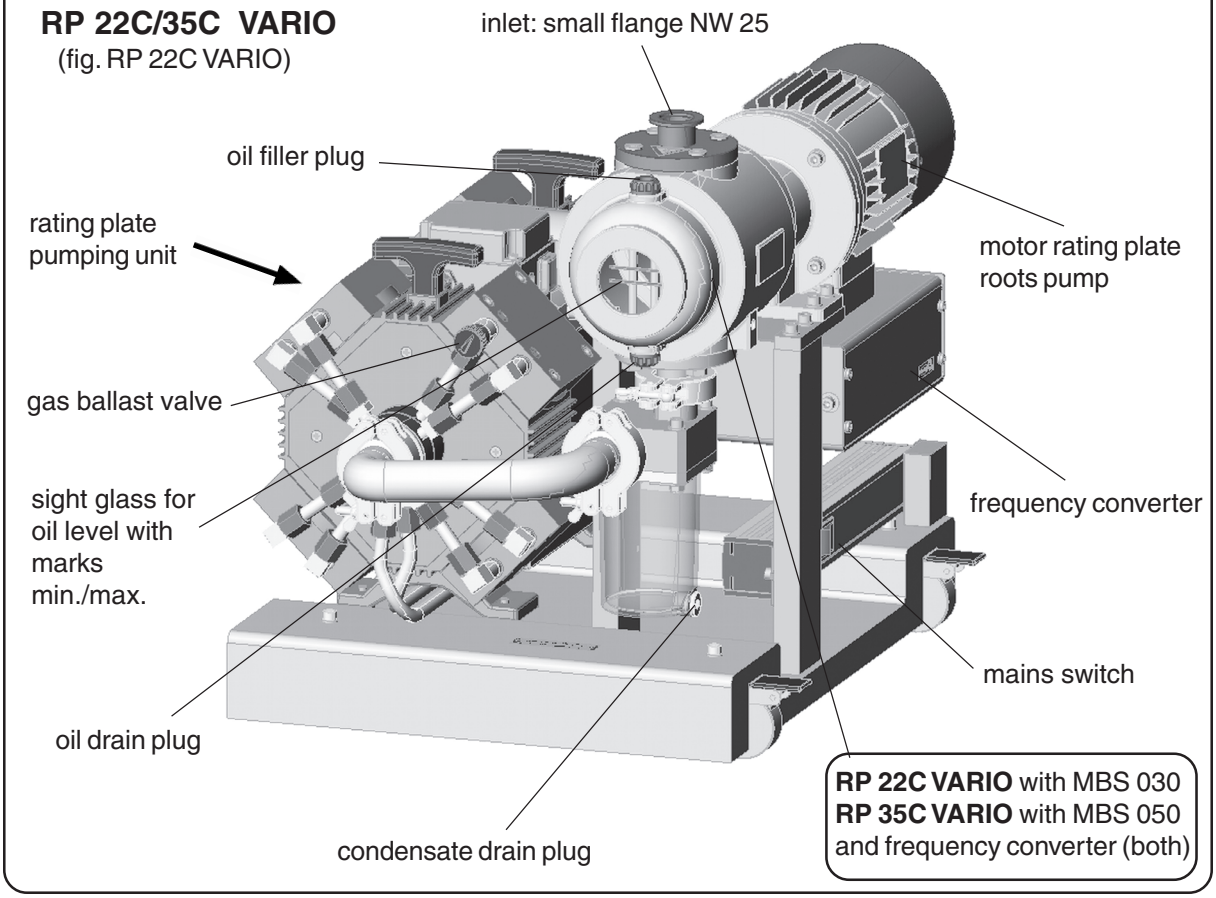
RP 12C / 15C VARIO

(fig. RP 15C VARIO)


inlet: small flange NW 25
motor rating plate roots pump
oil filler plug
sight glass for oil level with marks min./max.
frequency converter
oil drain plug
rating plate pumping unit
condensate drain plug
mains switch
RP 12C with MBS 030
RP 15C VARIO with MBS 030 and frequency converter

RP 22C/35C VARIO

(fig. RP 22C VARIO)


inlet: small flange NW 25
oil filler plug
rating plate pumping unit
motor rating plate roots pump
gas ballast valve
sight glass for oil level with marks min./max.
frequency converter
mains switch
oil drain plug
condensate drain plug
RP 22C VARIO with MBS 030
RP 35C VARIO with MBS 050 and frequency converter (both)

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Use and operation

Installation in a vacuum system

- ☞ Avoid throttling losses by using connecting pipes with large diameter and keep them as short as possible.
- ☞ Reduce the transmission of vibration and prevent loading due to rigid pipelines. Insert elastic hoses or flexible elements as couplings between the pump and rigid pipes. **Attention:** Flexible elements tend to shrink when evacuated.
- ☞ Use a suitable valve to isolate the pump from the vacuum system to allow the pump to warm up before condensable vapours are pumped or to clean the pump before it is switched off.
- ☞ Connect the exhaust to a suitable treatment plant to prevent the discharge of dangerous gases and vapours to the surrounding atmosphere. Use a catchpot to prevent the drainage of contaminated condensate back into the pump.

Prior to use

- ☞ **Max. ambient temperature**: 40 °C
- ☞ Check that mains voltage and current conform with the equipment.
- ☞ Make sure ventilation is adequate if pump is installed in a housing or if ambient temperature is elevated. Keep a distance of min. 20 cm between fans and ambient parts.
- ☞ **Ambient temperature** should be at least 12 °C, because otherwise the pump possibly does not start because of the high oil viscosity at low temperature.
- ☞ If the pump is installed in altitudes of more than 1000 m above mean sea level check compatibility with applicable safety requirements, e. g. IEC 60034 (motor may overheat due to insufficient cooling).

Attention: Before use pour oil into roots pump.
(See section oil change.)

- ☞ Prevent internal condensation, transfer of liquids or dust.
- ☞ The rotors of the pump may block.
- ☞ Pumping of liquids or dust damages the roots pump as well as the diaphragms and valves of the diaphragm pump.
- ☞ If the gas ballast valve is open, a power failure may cause unintentional ventilation of the pump. In case this constitutes a potential source of danger, take appropriate safety measures (e. g. install a electromagnetic operated gas ballast valve).
- ☞ Only operate the pumping unit in a horizontal **normal position**. **Avoid turning if pump is transported with oil filling**. Oil may enter the separator or the pump chamber of the roots pump, if the pump is tilted more than 15°.
- ☞ When assembling, ensure vacuum-tightness**.** After assembly, check the complete system for **leaks**.

- ☞ Check **oil level** of the roots pump every time before starting the pump, however at least once a week. Check oil level more frequently if high gas or vapour quantities are pumped.

During operation

- ☞ Pumping down can be started at any pressure, max. at atmospheric pressure.

For the pumping unit **RP 12C continuous operation** is possible only at inlet pressures < 50 mbar.

The roots pump in the pumping units **RP 15C/22C/35C VARIO** are equipped with a frequency control unit, which adapts the frequency of the roots pump according to the inlet pressure via a maximum current control.

- ☞ **Continuous operation** is possible at any pressure below atmospheric pressure.

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- ☞ The frequency is reduced at high inlet pressures (especially at atmospheric pressure) in order to avoid thermal overload of the roots pump.
- ☞ Under normal conditions, the maximum pump speed is reached only at inlet pressures < 50 mbar.
- ☞ The noise level can be different when evacuating.

- ☞ The pump achieves its pumping speed, ultimate total vacuum and vapour pumping rate only at operating temperature (after approx. 60 minutes).

In case of **oil in the separator:**
- ☞ The shaft seal of the roots pump may leak. **Note:** Also if the shaft seal is not damaged, a small amount of oil may enter the pump chamber of the roots pump.
- ☞ Not degassed lubrication oil may foam.
- ☞ May this be caused by an oblique position of the roots pumping unit?

- ☞ Oil consumption increases at inlet pressures above 100 mbar. Check oil level at shorter intervals.

- ☞ Operate the pump without gas ballast only with clean systems and without condensable vapours.
- ☞ Let the pump run with gas ballast to reduce condensation of pumped substances (water vapour, solvents, ...) in the pump or to decontaminate the pump oil from volatile substances. The manual gas ballast valve is open if the arrow on the gas ballast cap points upwards (RP 12C and 15C VARIO) or away from the diaphragm pump (RP 22C/35C VARIO).
- ☞ In case of pumping aggressive, corrosive or otherwise dangerous gases and vapours, take **appropriate measures** to protect pump and environment by using appropriate equipment such as cold trap, separator, oil separator, full flow oil filter, shut-off valve as well as special oil.

Shut down:

Has the pump been exposed to condensate?
- ☞ **Allow the pump to continue to run at atmospheric pressure for a few minutes, then with the inlet closed.**
- ☞ Stop pumping unit and admit air.
- ☞ Drain condensate, if necessary.

Has the pump been exposed to media which may damage the pump materials or form **deposits**?
- ☞ Let the pump continue to run for a longer time with the gas ballast valve open, check and clean pump heads if necessary.

Short-term:
- ☞ Wait at least 60 s before restarting the pumping unit (RP 15C/22C/35C VARIO only).

Long-term:
- ☞ Separate pump from the apparatus.
- ☞ Flush pump with dry nitrogen.
- ☞ Change oil.
- ☞ Fill the pump with new oil (not above upper level line!).
- ☞ Close manual gas ballast valve.
- ☞ Close inlet and outlet port (e. g. with transport caps or blind flanges).
- ☞ Store the pump in dry conditions.
- ☞ If necessary carry out oil change and maintenance prior to use if the pump is stored for a longer time.

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Troubleshooting

Fault	Possible cause	Remedy
❑ Pump fails to start or stops immediately.	➔ Mains not plugged in, electrical supply failure?	☞ Plug in. Check fuse.
	➔ Pressure in outlet pipeline too high?	☞ Remove blockade in line, open valve.
	➔ Motor overloaded?	☞ Allow motor to cool, identify and remove cause of failure.
	➔ Diaphragm pump switched off?	☞ Switch on diaphragm pump at terminal box of diaphragm pump. Keep switched on all times.
	➔ Diaphragm pump blocked?	☞ Contact local distributor.
❑ Diaphragm pump operates, roots pump does not.	➔ Operating at high pressure?	☞ Check operation conditions, exclude leak at inlet.
	➔ Roots pump has blocked?	☞ Contact local distributor.
	➔ Thermal overload of roots pump motor?	☞ Allow motor to cool, check fan. Identify and remove cause of failure.
	➔ Lubrication oil at low temperature?	☞ Ventilate for a short time, restart the unit.
	➔ Cable of roots pump not plugged in?	☞ Plug in roots pump.
	➔ RP 15/22/35C VARIO: Frequency control unit defective?	☞ Contact local distributor.
❑ Pump does not achieve ultimate total pressure or normal pumping speed.	➔ Centering ring not correctly positioned or leak in the pipeline or vacuum system?	☞ Check pump directly with a vacuum gauge at pump inlet, check connections and line.
	➔ Long, narrow line?	☞ Use line with larger diameter, length as short as possible.
	➔ Foreign particles in the oil or too low oil level?	☞ Carry out oil change, check oil level.
	➔ Outgasing substances or vapour generated in the process?	☞ Check process parameters.
	➔ Valves or diaphragms damaged?	☞ Replace valves and/or diaphragms.
	➔ Oil filler or oil drain plug not correctly assembled?	☞ Thighten plug.
	➔ Shaft seal at the motor side defective?	☞ Replace shaft seal or contact local distributor.

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❑ Oil leakage under the motor flange of the roots pump?	➔ Shaft seal at the motor side defective?	☞ Replace shaft seal or contact local distributor.
❑ Oil in the separator.	➔ Too much oil?	☞ Lower oil level to mark max.
	➔ Small leakage in shaft seal?	☞ Top up oil level if necessary.
	➔ Shaft seal is leaking to such a degree, that the process cannot be carried out?	☞ Contact local distributor or replace roots pump aggregate.
	➔ Foaming of not degassed lubrication oil?	☞ Empty the catchpot of the separator.
	➔ Pumping unit has not been operated in normal position?	☞ Operate pumping unit in normal position.
❑ Pump too noisy.	➔ Atmospheric or high pressure at inlet port?	☞ Connect hoose to pump outlet. Pay attention to max. allowed pressure at operation.
	➔ Diaphragm clamping disc loose?	☞ Perform maintenance.
	➔ Too low oil level?	☞ Fill in oil to the middle of the sight glass.
	➔ None of the above mentioned causes?	☞ Contact local distributor.
❑ Pump seized.		☞ Contact local distributor.

A **service manual** with exploded view drawings, spare part lists and directions for repair of the diaphragm pump only is available on request.
☞ The **service manual** is for trained service people.

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Oil change

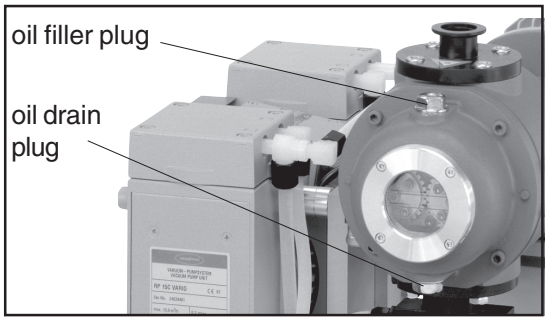
Before starting maintenance, isolate the pump from the vacuum system and the electrical supply so that the pump cannot be operated accidentally.

Has the pump been exposed to dangerous or corrosive gases?
Take appropriate safety measures (e. g. safety-clothing and protective goggles) to avoid inhalation and skin contact.
The pump and the oil may be contaminated with pumped chemicals which have been pumped, adopt suitable decontamination measures if necessary.

Aging of the oil necessitates oil change in case of darker colour (see new oil), strange odour of the oil or foreign particles.
Depending on individual cases (especially if corrosive gases or vapours have been pumped) it may be efficient to check the oil at appropriate intervals.

Under **normal operating conditions**:
- ☞ Check oil level every time before starting the pump.
- ☞ Change oil on a yearly basis at the latest.
- ☞ Dispose of the used oil, which may be contaminated by chemicals, according to all applicable regulations.

Oil change:
- ☞ Heat pump to operating temperature before changing oil.
- ☞ Isolate the pump from the electrical supply and admit air.
- ☞ Choose suitable pad, oil may drop.



- ☞ Remove oil filler plug and oil drain plug.
- ☞ Tilt pump and catch oil in a suitable container.
- ☞ Dispose of the used oil according to the regulations.
- ☞ Reassemble oil drain plug with O-ring.
- ☞ To flush the pump, pour in fresh oil (approx. 50 ml) through the pump inlet.
- ☞ Operate the pump briefly, drain flushing oil and repeat flushing procedure if necessary.
- ☞ Fill in fresh oil through the oil inlet port until oil level reaches mark Max. in the sight glass.
  Note: The oil flows from the gearing side of the roots pump through a connecting bore in the housing to the motor side.
- ☞ Check oil level after some minutes, pour in oil if necessary.
- ☞ Do not use too much oil - oil may enter the pump chamber.
- ☞ Close oil filler plug.

- ☞ Recommended oil (B-oil, 1l) **68 70 10**

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Replacing diaphragms and valves

All bearings are encapsulated and are filled with long-life lubricant. Under normal operating conditions, the pump is maintenance free. The valves and diaphragms as well as the motor capacitors are wear parts. If the rated ultimate vacuum is no longer achieved or in case of increased noise level, the pump interior, the diaphragms and the valves must be cleaned and the diaphragms and valves must be checked for cracks or other damage. Check every capacitor regularly by measuring its capacity and estimating its operation time. Exchange old capacitors early enough to prevent a failure. The capacitors have to be replaced by an electrician. Depending on individual cases it may be efficient to check and clean the pump heads on a regular basis. In case of normal wear the lifetime of the diaphragms and valves is > 10000 operating hours.

☞ Prevent internal condensation, transfer of liquids or dust. The diaphragm and valves will be damaged, if liquids are pumped in significant amount.

If the pump is exposed to corrosive media or in case of deposits, maintenance should be carried out frequently.

☞ Regular maintenance will improve the lifetime of the pump and also protect both man and environment.

Ensure that maintenance is done only by suitable trained and supervised technicians.

☞ Ensure that the pump cannot be operated accidentally. **Never operate the pump if covers or other parts of the pump are disassembled. Never operate a defective or damaged pump.**

☞ **Before starting maintenance** isolate the pump from the electrical supply and wait **two minutes** after isolating the equipment from mains to allow the capacitors to discharge. Avoid the release of pollutants. Allow sufficient cooling of the pump.

☞ Attention: The pump might be contaminated with the process chemicals that have been pumped during operation. Ensure that the pump is decontaminated before maintenance and take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred. Ensure that the maintenance technician is familiar with the safety procedures which relate to the products processed by the pumping system.

☞ Wear appropriate safety-clothing when you come into contact with contaminated components. Drain condensate. Avoid the release of pollutants.

Before starting maintenance vent the pump and isolate it from the vacuum system.

Tools required (metric)**:**

- Phillips screw driver, size 2
- Open-ended wrench w/f 15/17
- Hex key size 5
- Face wrench with torque indicator

Face wrench with torque indicator **63 75 80**

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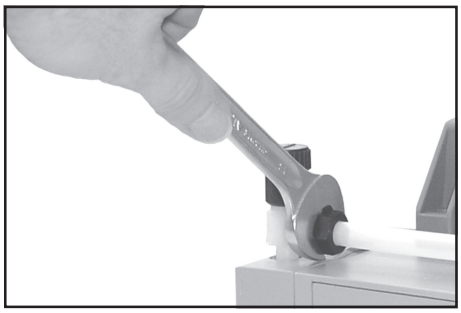
RP 12C and RP 15C VARIO (with MD 4C)

Set of seals (diaphragms and valves) for MD 4C 69 68 15

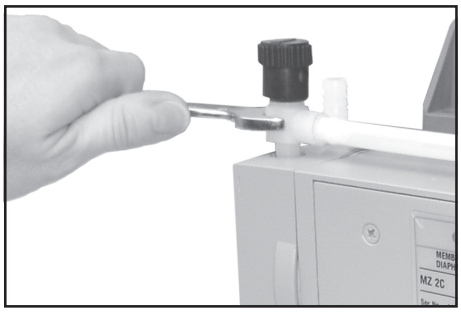
☞ **Please read the whole chapter ”Replacing diaphragms and valves” before starting maintenance.**
Partially the pictures show pumps in other versions. This doesn´t influence replacing diaphragms and valves of the pump.

☞ **If necessary, disassemble diaphragm pump MD4C from pumping unit.**

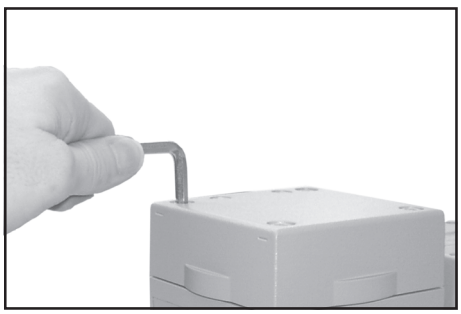
Cleaning and inspecting the pump heads:



➨ Use open-ended wrench (w/f 17) to remove union nuts.



➨ Use open-ended wrench (w/f 15) to turn elbow fitting 1/4 of a turn, remove hose.
☞ Do not remove the elbow fitting from the pump head. Through reassembly a leak may result.



➨ To check valves use hex key to remove four socket head screws from pump head and remove upper housing (housing cover with housing cover insert), head cover and valves.
☞ Never remove parts by using a spiky or sharp-edged tool (e.g. screw driver), we recommend to use a rubber mallet or compressed air (to be blown carefully into port).
➨ Remove head cover from housing cover insert and check valves. Note position of valves and remove.
☞ Replace valves if necessary.
☞ Use petroleum ether or industrial solvent to remove deposits. Do not inhale.

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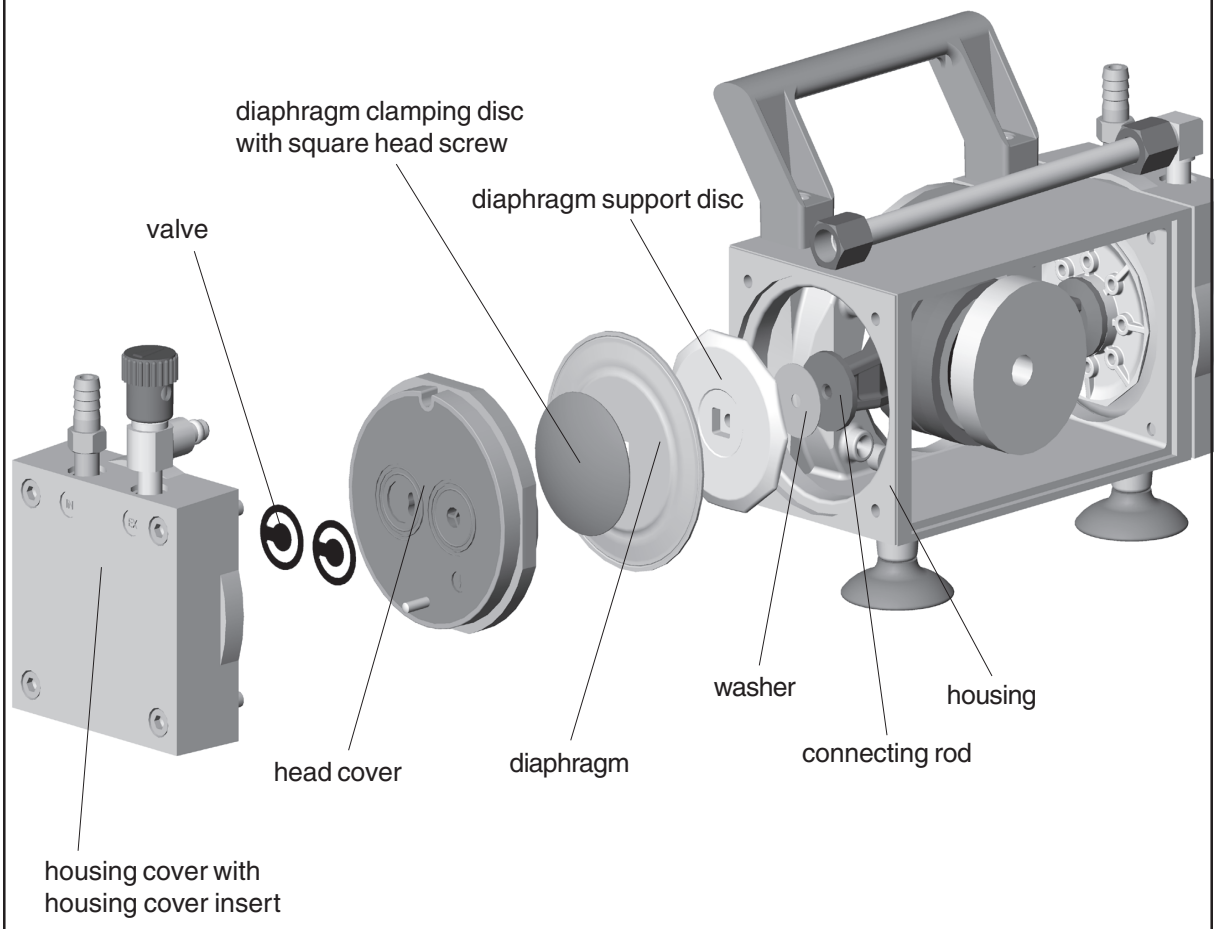
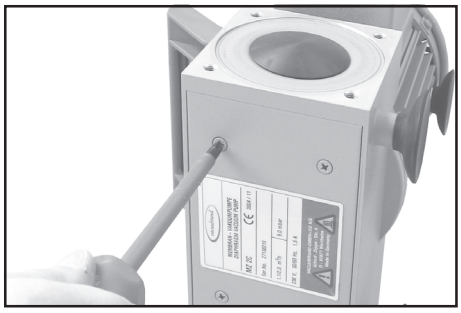
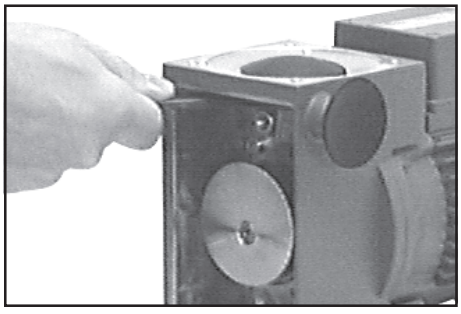
View of the disassembled pump head parts





☞ Check diaphragm for damage and replace if necessary.
➨ To do so use Phillips screw driver to remove four countersunk head screws and lift off housing plate with rating plate.
☞ Use petroleum ether or industrial solvent to remove deposits if necessary. Do not inhale.

Replacing the diaphragm



➨ Use face wrench to remove diaphragm support disc.
➨ Check for washers under clamping disc. Do not mix the washers from the different heads. Make sure that the original number is reassembled at the individual pump head.
☞ Smaller number of washers: The pump will not attain ultimate vacuum. More washers: Clamping disc will hit head cover; noise or even blockade of the pump.

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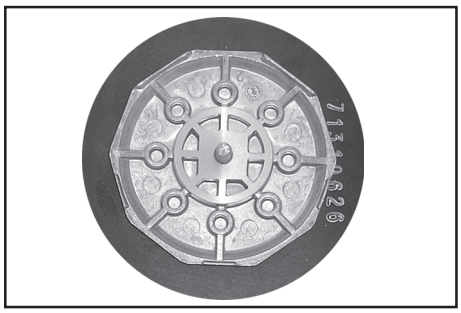
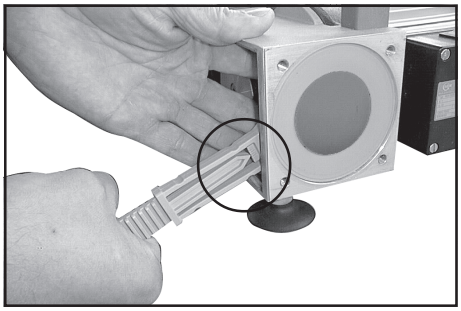


➨ Position new diaphragm between diaphragm clamping disc with square head screw and diaphragm support disc.
☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.
☞ **Note:** Position diaphragm with white PTFE side to diaphragm clamping disc (to pump chamber).

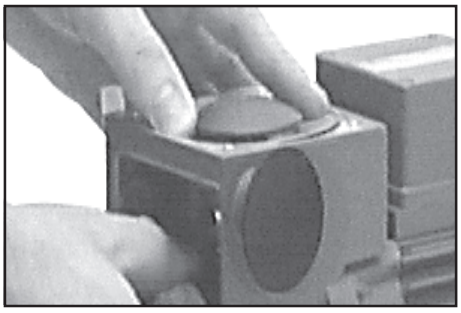


➨ Use **face wrench with torque indicator** (recommended: **face wrench with torque indicator from VACUUBRAND, Cat.-No.: 63 75 80**) to assemble diaphragm clamping disc, diaphragm and diaphragm support disc (and eventually washers) to the connecting rod.
☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.

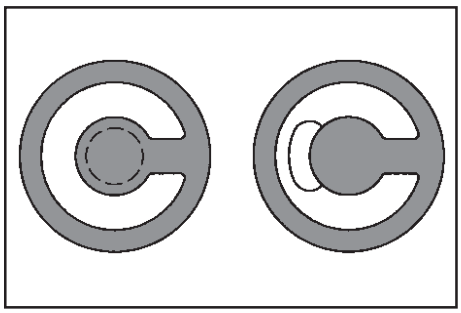
Optimum torque for the diaphragm support disc: **6 Nm.**

☞ The optimum torque is achieved if the pointer in the handle of the VACUUBRAND face wrench shows to the longer marking line.

Assembling pump heads

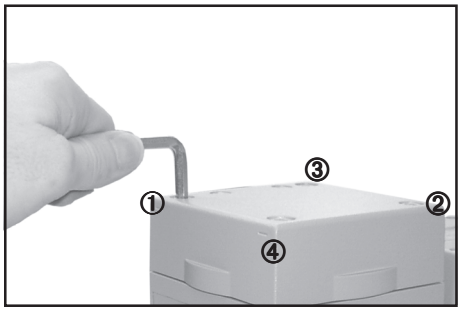


➨ By turning eccentric bushing (front of connecting rod), bring connecting rod into a position in which diaphragm is in contact with housing and centred with respect to bore.



Reassemble in reverse order.

➨ Install head cover, valves and housing cover with housing cover insert.
☞ Make sure that the **valves are correctly seated**: Valves at the outlet with round centred opening under valve, valves at the inlet with kidney-shaped opening beside valve.
➨ By turning eccentric bushing, bring connecting rod into upper turning point position (Max. stroke of the rod).
☞ Pay attention that the diaphragm stays positioned centrally so that it will become clamped uniformly between housing and head cover.



➨ Screw in four socket head screws fixing housing cover crosswise (e. g. in the sequence ①, ②, ③, ④) first slightly, then tighten.
☞ Do not tighten until head cover is in contact with housing, torque **12 Nm**.

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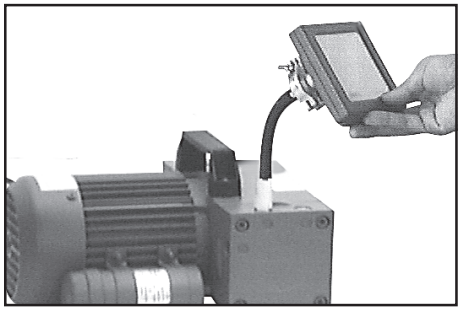
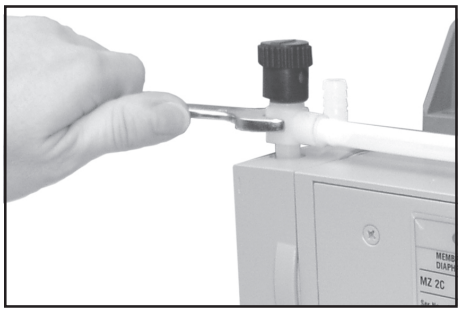
Individual performance check of a pump head :



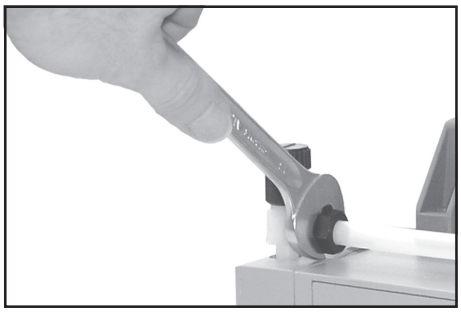
By measuring the pressure at the inlet port of the individual head:
Use a suitable vacuum gauge (e. g. DVR 2, cat. no.: 68 29 02), make sure that it is correctly calibrated, and measure the pressure at the inlet port. A vacuum of less than 120 mbar should be indicated.

☞ If the reading is higher, recheck the pump chamber and make sure that the valves and the diaphragms are correctly seated (diaphragms concentric with bore).

Assembling fittings:



➨ Use open ended wrench (w/f 15) to reconnect hose to elbow fitting.



➨ Tighten union nuts first by hand and then tighten one full turn using open ended wrench (w/f 17).

☞ Reassemble the pumping unit.

If the pump does not achieve the ultimate pressure:

☞ In case the diaphragms and valves have been replaced, a run-in period of several hours is required before the pump achieves its ultimate vacuum.

If all pump heads achieve a vacuum below 120 mbar but pump does not achieve the ultimate total pressure:
Check hose connectors between pump heads and manifolds for leaks. If necessary recheck pump chamber. If necessary disassemble fittings again and screw in the elbow fittings another turn, use PTFE sealing bond as necessary.

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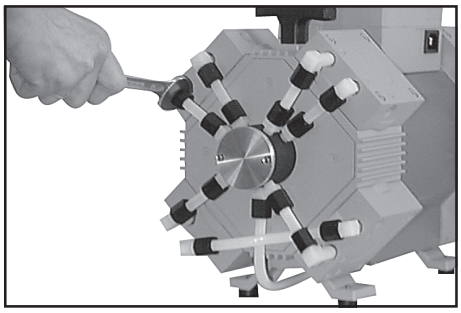
RP 22C/35C VARIO (with MD 12C)

Set of seals (diaphragms and valves) for MD 12C 69 68 21

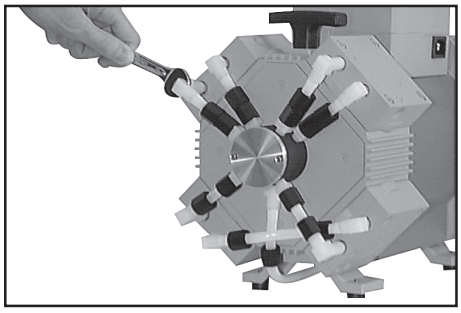
☞ **Please read the whole chapter ”Replacing diaphragms and valves” before starting maintenance.**
Partially the pictures show pumps in other versions. This doesn´t influence replacing diaphragms and valves of the pump.

☞ **If necessary, disassemble diaphragm pump MD 12C from pumping unit.**

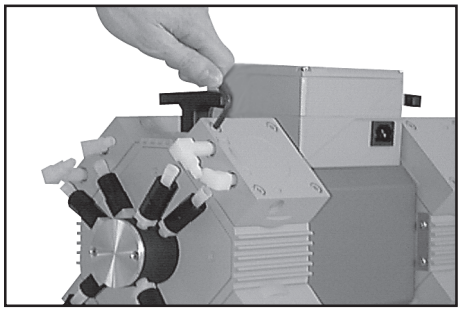
Cleaning and inspecting the pump heads:



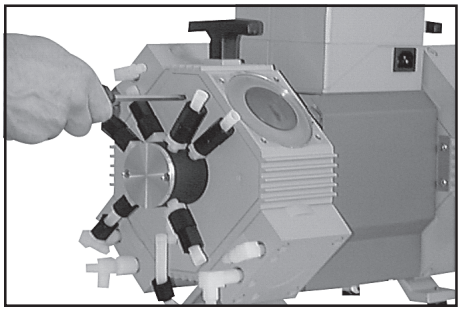
➨ Use open-ended wrench (w/f 17) to remove union nuts.



➨ Use open-ended wrench (w/f 15) to turn elbow fitting 1/4 of a turn, remove hose.
☞ Do not remove the elbow fitting from the pump head. Through reassembly a leak may result.



➨ To check valves use hex key to remove four socket head screws from pump head and remove upper housing (housing cover with housing cover insert), head cover, valves and O-rings if applicable.
☞ Never remove parts by using a spiky or sharp-edged tool (e.g. screw driver), we recommend to use a rubber mallet or compressed air (to be blown carefully into port).
➨ Remove head cover from housing cover insert and check valves. Note position of valves and remove.
☞ Replace valves if necessary.
☞ Use petroleum ether or industrial solvent to remove deposits. Do not inhale.



☞ Check diaphragm for damage and replace if necessary.
➨ Use Phillips screw driver to remove four countersunk head screws and lift off housing plate together with fittings and manifold.

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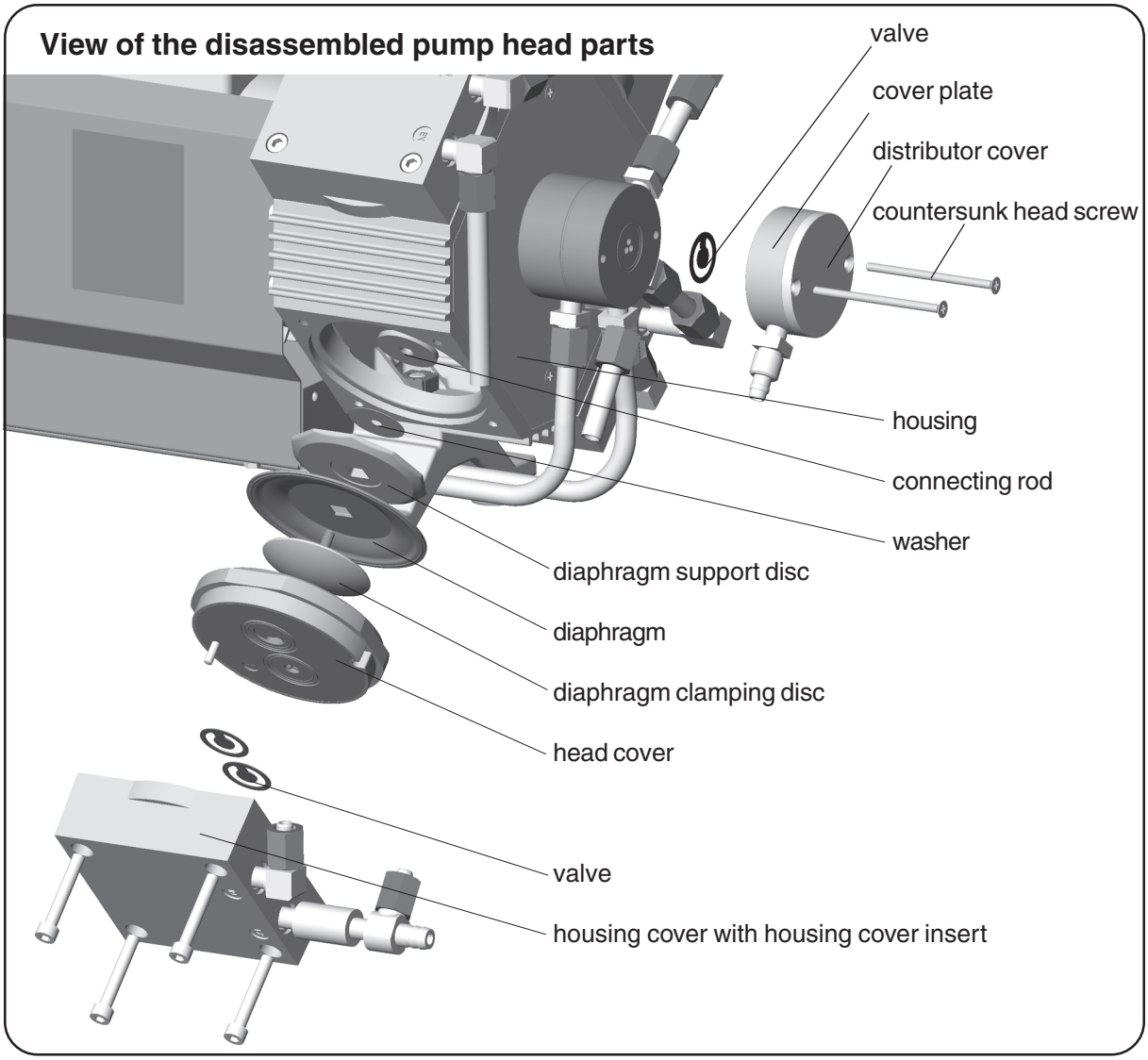
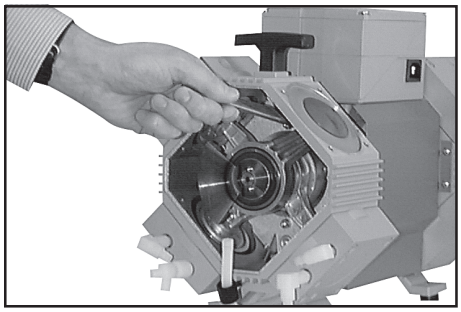
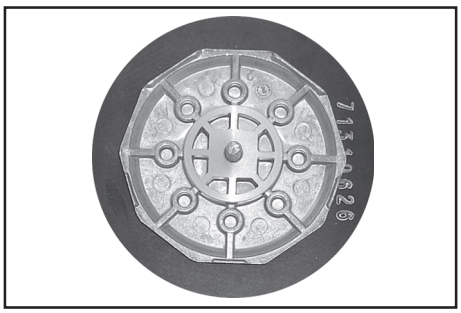
View of the disassembled pump head parts



Replacing the diaphragm:



- ➨ Use a face wrench to remove diaphragm support disc.
- ➨ Check for washers. Do not mix the washers from the different heads. Make sure that the original number is reassembled at the individual pump head.
- ☞ Smaller number of washers: The pump will not attain ultimate vacuum. More washers: Clamping disc will hit head cover; noise or even blockade of the pump.



- ➨ Position new diaphragm between diaphragm clamping disc with square head screw and diaphragm support disc.
- ☞ **Note:** Position diaphragm with white PTFE side to diaphragm clamping disc (to pump chamber).
- ☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.

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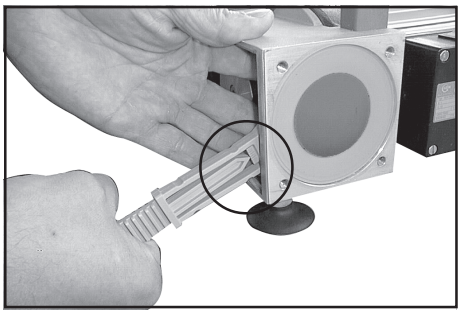


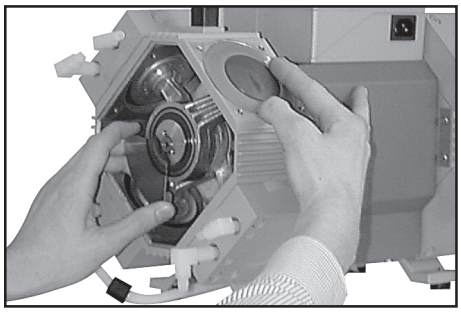
➨ Use **face wrench with torque indicator** (recommended: **face wrench with torque indicator from VACUUBRAND, Cat.-No.: 63 75 80**) to assemble diaphragm clamping disc, diaphragm and diaphragm support disc (and eventually washers) to the connecting rod.

☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.

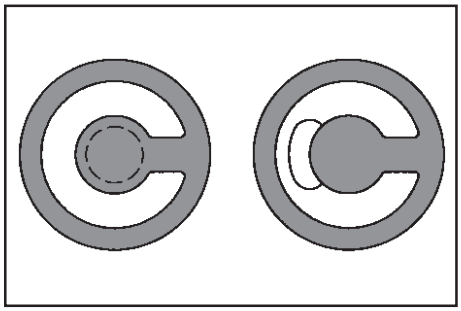
Optimum torque for the diaphragm support disc: **6 Nm.**

☞ The optimum torque is achieved if the pointer in the handle of the VACUUBRAND face wrench shows to the longer marking line.

Assembling pump heads:



➨ By turning eccentric bushing (front of connecting rod), bring connecting rod into a position in which diaphragm is in contact with housing and centred with respect to bore.



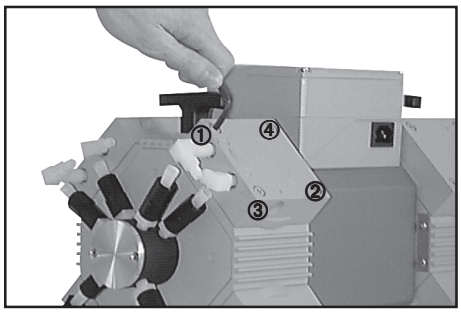
Reassemble in reverse order.

➨ Install head cover (with O-ring if applicable), valves and housing cover with housing cover insert.

☞ Make sure that the **valves are correctly seated**: Valves at the outlet with round centred opening under valve, valves at the inlet with kidney-shaped opening beside valve.

➨ By turning eccentric bushing, bring connecting rod into upper turning point position (Max. stroke of the rod).

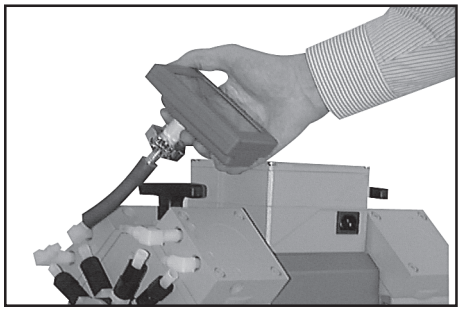
☞ Pay attention that the diaphragm stays positioned centrally so that it will become clamped uniformly between housing and head cover.



➨ Screw in four socket head screws fixing housing cover crosswise (e. g. in the sequence ①, ②, ③, ④) first slightly, then tighten.

☞ Do not tighten until head cover is in contact with housing, torque **12 Nm**.

Individual performance check of a pump head:



By measuring the pressure at the inlet port of the individual head:

➨ Use a suitable vacuum gauge (e. g. DVR 2, cat. no.: 68 29 02), make sure that it is correctly calibrated, and measure the pressure at the inlet port. A vacuum of less than 120 mbar should be indicated.

☞ If the reading is higher, recheck the pump chamber and make sure that the valves and the diaphragms are correctly seated (diaphragms concentric with bore).

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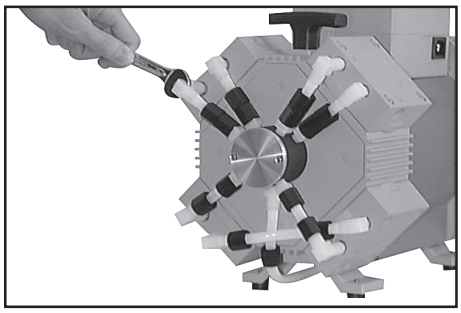
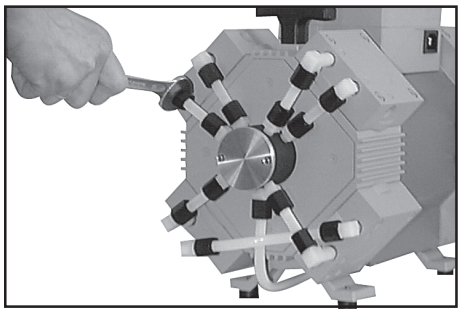
Montage of the connecting hose:



➨ Use open ended wrench (w/f 15) to reconnect hose to elbow fitting.



➨ Tighten union nuts first by hand and then tighten **one** full turn using open ended wrench (w/f 17).

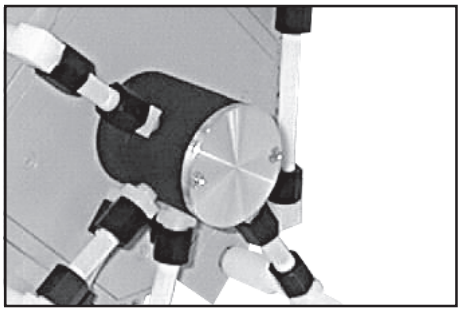
☞ Reassemble the pumping unit.

If the pump does not achieve the ultimate pressure:

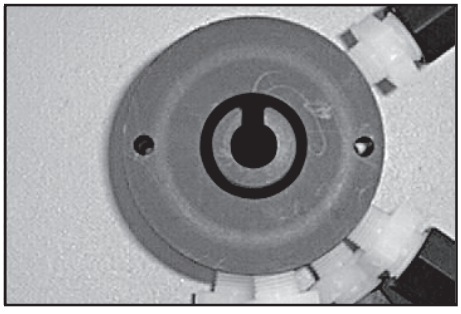
☞ In case the diaphragms and valves have been replaced, a run-in period of several hours is required before the pump achieves its ultimate vacuum.

If all pump heads achieve a vacuum below 120 mbar but pump does not achieve the ultimate total pressure:
Check hose connectors between pump heads and manifolds for leaks. If necessary recheck pump chamber.

Changing the valve at the outlet manifold



➨ Use open-ended wrench (w/f 17) to loosen the union nut of the hose, which runs directly to the cover plate of the outlet manifold, at the pump head.
➨ Use open-ended wrench (w/f 15) to turn elbow fitting 1/4 of a turn, remove hose. Do not remove the elbow fitting from the pump head.
➨ Unscrew the countersunk head screws at the manifold cover and remove cover plate and manifold cover.



➨ Note position of valve and remove.
☞ Check valve for damage and replace if necessary. Make sure that the valve is correctly seated.
➨ Reassemble cover plate and manifold cover.
➨ Use open ended wrench (w/f 15) to reconnect hose to elbow fitting
➨ Tighten union nut first by hand and then tighten **one** full turn using open-ended wrench (w/f 17).

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Notes on return to the factory

Repair - return - DKD calibration

Safety and health of our staff, laws and regulations regarding the handling of dangerous goods, occupational health and safety regulations and regulations regarding safe disposal of waste require that for all pumps and other products the **"Health and safety clearance form"**
must be send to our office duly completed and signed before any equipment is dispatched to our premises.
Fax or post a completed copy of the health and safety clearance form to us in advance. The declaration must arrive before the equipment. Enclose a second completed copy with the product. If the equipment is contaminated you must notify the carrier.

No repair / DKD calibration is possible unless the correctly completed form is returned. Inevitably, there will be a delay in processing the equipment if information is missing or if this procedure is not complied with.

If the product has come in contact with chemicals, radioactive substances or other substances dangerous to health or environment, the product must be decontaminated prior to **sending it back to the factory.**

- ☞ Return the product to us **disassembled and cleaned** and accompanied by a certificate verifying decontamination or
- ☞ Contact an industrial cleaning and **decontamination service** directly or
- ☞ Authorize us to send the product to an industrial cleaning facility **at your expense.**

To expedite repair and to reduce costs, please enclose a detailed description of the problem and the product´s operating conditions with every product returned for repair.
We submit **quotations** only on request and always at the customer´s expense. If an order is given, the costs incurred are offset from the costs for repair or from the purchase price, if the customer prefers to buy a new product instead of repairing the defective one.

- ☞ **If you do not wish a repair on the basis of our quotation, the equipment might be returned to you disassembled and at your charge!**

In many cases, the **components must be cleaned in the factory** prior to repair.
For cleaning we use an environmentally responsible water based process. Unfortunately the combined attack of elevated temperature, cleaning agent, ultrasonic treatment and mechanical stress (from pressurised water) may result in damage to the paint. Please mark in the health and safety clearance form if you wish a **repaint at your expense** just in case such a damage should occur.
We also replace parts due to optical aspects upon your request.
Before returning the equipment ensure that (if applicable):

- ☞ Oil has been drained and an adequate quantity of fresh oil has been filled in to protect against corrosion.
- ☞ Equipment has been cleaned and/or decontaminated.
- ☞ All inlet and outlet ports have been sealed.
- ☞ Equipment has been properly packed, if necessary, please order an original packaging (costs will be charged), marked as appropriate and the carrier has been notified.
- ☞ Ensure that the completed health and safety declaration is enclosed.

We hope for your understanding for these measures, which are beyond our control.
Scrapping and waste disposal:
Dispose of the equipment and any components removed from it safely in accordance with all local and national safety and environmental requirements. Particular care must be taken with components and waste oil which have been contaminated with dangerous substances from the process. Do not incinerate fluoroelastomer seals and "O"-rings.

- ☞ You may authorize us to dispose of the equipment **at your expense.**

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Health and safety clearance form

Declaration concerning safety, potential hazards and safe disposal of waste, e. g. used oil.
Safety and health of our staff, laws and regulations regarding the handling of dangerous goods, occupational health and safety regulations, safety at work laws and regulations regarding safe disposal of waste, e. g. waste oil, require that for all pumps and other products this form must be sent to our office duly completed and signed before any equipment is dispatched to our premises. **Products will not be accepted for any procedure and handling and repair / DKD calibration will not start before we have received this declaration.**

a) Fax or post a **completed copy of this form** to us in advance. The declaration must arrive before the equipment. **Enclose a second, completed copy with the product.** If the product is contaminated you must notify the carrier (**GGVE, GGVS, RID, ADR**).
b) Inevitably, the repair process will be delayed considerably, if this information is missing or this procedure is not complied with. We hope for your understanding for these measures which are beyond our control and that you will assist us in expediting the repair procedure.
c) **Make sure that you know all about the substances which have been in contact with the equipment and that all questions have been answered correctly and in detail.**

1. Product (Model): .....

2. Serial No.: .....

3. List of substances in contact with the equipment or reaction products:

3.1 Chemical/substance name, chemical symbol:

a) .....

b) .....

c) .....

d) .....

3.2 Important information and precautions, e. g. danger classification:

a) .....

b) .....

c) .....

d) .....

4. Declaration (please mark as applicable):

❑ **4.1 for non dangerous goods:**

We assure for the returned product that
- neither toxic, corrosive, biologically active, explosive, radioactive nor contamination dangerous in any way has occurred.
- the product is free of dangerous substances.
- the oil or residues of pumped media have been drained.

❑ **4.2 for dangerous goods:**

We assure for the returned product that
- all substances, toxic, corrosive, biologically active, explosive, radioactive or dangerous in any way which have pumped or been in contact with the product are listed in 3.1, that the information is complete and that we have not withheld any information.
- the product, in accordance with regulations, has been
  ❑ cleaned ❑ decontaminated ❑ sterilized.

5. Way of transport / carrier:

.....

Day of dispatch to VACUUBRAND:

.....

If the paint is damaged, we wish a repaint or a replacement of parts due to optical aspects at our expense (see "Notes on return to the factory"):

❑ yes ❑ no

We declare that the following measures - where applicable - have been taken:
- The oil has been drained from the product. **Important: Dispose of according to national regulations.**
- The interior of the product has been cleaned.
- All inlet and outlet ports of the product have been sealed.
- The product has been properly packed, if necessary, please order an original packaging (costs will be charged) and marked as appropriate.
- The carrier has been informed about the hazardous nature of the goods (if applicable).

We assure VACUUBRAND that we accept liability for any damage caused by providing incomplete or incorrect information and that we shall indemnify VACUUBRAND from any claims as regards damages from third parties.

We are aware that as expressed in § 823 BGB (Public Law Code of Germany) we are directly liable for injuries or damages suffered by third parties, particularly VACUUBRAND employees occupied with handling/ repairing the product.

Signature: .....

Name (print): .....

Job title (print): .....

Company´s seal: .....

Date: .....

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-Technology for Vacuum Systems-
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CE

Konformitätserklärung
Declaration of conformity
Déclaration de conformité

Pumpstand / Pumping unit / Groupe de pompage

RP 12C (230V; 691035, 691036, 691037)
RP 15C VARIO (230V; 691040, 691041, 691042)
RP 22C VARIO (230; 691050, 691051, 691052)
RP 35C VARIO (230V; 691060, 691061, 691062)

Hiermit erklären wir, dass das oben bezeichnete Gerät in Konzeption und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den grundlegenden Anforderungen der zutreffenden, aufgeführten EU-Richtlinien entspricht. Bei einer mit uns nicht abgestimmten Änderung an dem Gerät verliert diese Erklärung ihre Gültigkeit.
We herewith declare that the product designated above is in compliance with the basic requirements of the applicable EC-directives stated below with regard to design, type and model sold by us. This certificate ceases to be valid if the product is modified without the agreement of the manufacturer.
Par la présente, nous déclarons que le dispositif désigné ci-dessus est conforme aux prescriptions de base des directives EU applicables et indiqués en ci que concerne conception, dessin et modèle vendu par nous-mêmes. Cette déclaration cesse d´être valable si des modifications sont apportées au dispositif sans notre autorisation préalable.

Maschinenrichtlinie (mit Änderungen) / Machine directive (with supplements) / Directive Machines (avec des suppléments)
2006/42/EG
Niederspannungsrichtlinie / Low-Voltage Directive / Directive Basse Tension
2006/95/EG
Richtlinie Elektromagnetische Verträglichkeit / Electromagnetic Compatibility Directive / Directive Compatibilité Electromagnétique
2004/108/EG
Angewandte Harmonisierte Normen / Harmonized Standards applied / Normes Harmonisées utilisées
DIN EN 12100-2, DIN EN 61010-1, DIN EN 1012-2, DIN EN 61326-1, DIN EN 61800
Managementsysteme / Management systems / Systèmes de Management
EN ISO 9001, EN ISO 14001 (1997-2006)

Wertheim, 22.12.2009
. . . . . .
Ort, Datum / place, date / lieu, date

. . . . . .
(Dr. F. Gitmans)
Geschäftsführer / Managing Director / Gérant

ppa. . . . . .
(Dr. J. Dirscherl)
Technischer Leiter / Technical Director / Directeur technique

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